REMARKS

Reconsideration of the above identified application in view of the preceding amendments and the following remarks is respectfully requested. First the Applicant and its attorneys wish to thank the Examiner for the allowance of claims 21 to 27 of the application and for the indication of allowable subject matter in dependent claim 20.

Former independent claim 17 and the claims dependent thereon have been cancelled as the subject matter of claim 17 is now included in amended claim 1, as is the subject matter of former claim 18. Claim 1 now includes the requirement that the inner tube have "a slot extending through the length of the inner tube" a feature recited in former claim 14 which has now been cancelled. In addition, claim 1 now requires that there be a second ring with an inner surface that engages the outer surface of the inner tube along a second selected length which is less than about 10 percent of the longitudinal length of the inner tube, the second ring also comprising the second material having the second coefficient of thermal expansion. Furthermore, claim 1 specifies that with respect to the first ring, its first selected length which engages the outer surface of the inner tube "is less than about 10 percent" of the longitudinal length of the inner tube. It should be noted that no new subject matter has been inserted into or added to claim 1. With respect to the requirement of the selected length of the first and second rings being less than about 10 percent of the longitudinal length of the inner tube, this feature is illustrated in Figure 3a of the application and is specifically mentioned in the last four lines of paragraph 29.

With reference now to the initial objection to the wording of the disclosure in paragraphs 25 and 26, paragraph 25 has been corrected to delete the second reference number "100" since the reference 100 is already used to identify an electrical source of heat generating energy 100. The incorrect reference number "120" appearing in the third last line of paragraph 26 has been corrected to read – 110 – which is the reference for the channel.

Turning now to the anticipation rejection of a number of claims including claims 1 to 3 and former independent claim 17 on the basis of either the '458 patent or the '094 patent, it is noted that neither of these references were cited against either original claim 4 of the application or original claim 14. The subject matter of both of these original claims is now included in claim 1. Accordingly, it is submitted that amended claim 1 clearly distinguishes over both of these US patents and is not anticipated thereby. In fact, the Examiner admits on page 3 of the Office Action that neither of these primary references "discloses a slot extending through the body length of the tube" a feature now recited in claim 1.

Turning to the rejection of a number of claims, including claims 4, 5, 7, 8, 10 and 11, on grounds of obviousness in view of either the '458 patent or the '094 patent, again, it is noted that the Examiner did not reject claim 14 on this ground and since claim 1 includes effectively all of the subject matter of former claim 14, it is submitted that this claim and the claims dependent thereon are not on fact obvious in view of the teachings of either of these references. Clearly, it would not be apparent to one skilled in this art after reading either reference to provide the inner tube with a slot extending through the length of the inner tube since this feature is not taught or suggested by either reference.

With respect to the obviousness rejection of former dependent claim 14 on the basis of the two primary references and US Patent No. 5, 360,333 to Schmidt, it is respectfully submitted that amended claim 1 which includes the subject matter of claim 14 does clearly and patentably distinguish over this combination.

To comment firstly on the '458 patent, this patent is directed to a high efficiency heater for ultra-pure fluids such as de-ionized water. The various tubes employed must be made of corrosive resistant material and in a preferred described embodiment, this material comprises quartz. The heater has an intermediate body portion 10 to which is attached a bottom end cap assembly 14 which does not appear to be ring in this particular patent but rather a solid cap (see Figure 1). The body portion 10 has an inner tube 18 which surrounds a central cavity 27 that is a void (see column 5 at lines 9 to 14). Thus, it is clear that this heater is intended for applications quite unlike either the heater assembly of the present invention or that

taught in the Schmidt reference, both of which are designed for use in injection molding. In the reference, the inner tube is surrounded by an inner heating element tube 20, a heating element assembly 22 on the outside of tube 20, an outer heating element tube 24 and finally an outer tube 26. There is an annular passage between tube 18 and tube 20 that carries fluid received from an inlet port 30. The outer heating element tube 24 is spaced radially inwardly from the outer tube 26 to define a second annular fluid path 32 for carrying fluid.

The **Base** reference, US Patent No. 5,954,094 is quite similar in its teachings to the '458 patent and appears to be directed simply to an improved end-cap for a fluid tube heater such as that in the '458 patent. Again, this known heater has an intermediate body portion 10 and an end-cap assembly 14 which is secured to one end of the body portion 10 and which forms a fluid-tight seal at this end. The fluid heater portion is formed from a number of concentrically arranged quartz tubes for the purpose of resisting the corrosive liquid that flows through the tubes. There is an inner quartz tube 16 which is surrounded by an inner heating element quartz tube 18 and spaced therefrom in order to define a first fluid pathway 20 (see Figure 2). The tube 18 is spaced rigidly inwardly from an outer heating element quartz tube 22 which is spaced radially inwardly from outer quartz tube 26. There is a second fluid pathway 28 that carries fluid received from the inner fluid pathway 20. A heating element assembly 24 in the form of a "ribbon" wire 30 is spirally wound around the inner heating element tube 18 and is connected to conductive ring 32 to form an electrical connection.

In particular, in the '094 patent the end cap assembly includes an intermediate end cap 34 which is surrounded by manifold cap 36 and these two caps cooperate to define an annular fluid manifold 38 that conveys operating fluid between the inner and outer fluid pathways. The two caps 34, 36 can be made from plastic that can resist the corrosive fluids for example PVDF. As appears to be appreciated by the Examiner, even if these two references were combined, the resulting combination would still not be the heater assembly required by amended claim 1. In particular, neither of these references discloses the following features:

(1) A heater assembly for mounting around a fluid flow channel in an injection molding apparatus (As indicated, the two primary references are both directed to a specialized heater which can be used in chemical processing in order to heat a corrosive liquid such as UPDI water);

(2) The inner tube of the assembly must have a slot extending through the length of the inner tube (Note that neither of the inner tubes 18 and 20 in the '458 Patent nor either of the inner tubes 16 and 18 in the '094 Patent can have such a slot as the annular space between these tubes is required to conduct on ultra-pure fluid such as UPDI and thus this requirement in claim 1 is directly contrary to the requirements for the heaters in these two patents);

(3) There must be a second ring in addition to a first ring which has an inner surface engaged with the outer surface of the inner tube along a second selected length (The Examiner states at the top of page 3 of the Office Action that neither reference discloses such a second ring); and

(4) Both rings must be made of a second material "having a second coefficient of thermal expansion that is less than the first coefficient of thermal expansion (In the reference, it appears that the plastic end cap assembly may expand more than the quartz tubes, in other words, the cap may have a coefficient of thermal expansion which is greater than the coefficient of thermal expansion of the quartz tubes (see for example, the passage in column 4 of the '094 patent at lines 8 to 13 which suggests that the wall 48 of the end cap can be compressed against the adjacent tube "to prevent the plastic material of the end cap 34 from expanding in a radial direction (due to thermal expansion) to such an extent as to cause damage....to one or more of the quartz

tubes) and in any event there is no teaching in either reference that the plastic end cap has a lower coefficient of expansion than the quartz tubes.

Turning now to the Schmidt reference No. 5,360,333 relied upon by the Examiner, this reference admittedly describes a bi-metallic clamping system for holding a heater firmly on the external surface of a hotrunner nozzle body. There is a heater sheath that includes a cylindrical inner sleeve 42 formed from a high conductivity material such as aluminium and a cylindrical outer sleeve 44 formed from a low conductivity material typically titanium. Obviously these materials are quite different from the quartz tubes of the two primary references. The Schmidt reference also teaches the use of a heater coil 46 which is positioned between the inner and outer sleeves and it can be positioned in one or more spaces 48 that are machined into the outer periphery of the inner sleeve. The inner sleeve has a relatively high thermal expansion while the outer sleeve 44 has a relatively low thermal expansion.

It is respectfully submitted that it would not be obvious to combine the teachings of either of the primary references with those of Schmidt in order to obtain the heater assembly of claim 1. One reason for this is that neither of the primary references teaches a tubular heater assembly that would be considered for use as a heater that could be mounted around a fluid flow channel in an injection molding apparatus. The intended application of the heater assembly of Schmidt is shown in Figure 1 and it is clear that the heater assembly is designed for use around a mold nozzle 22 that can include a skirt that forms an annular slot for the heater. On the other hand, in both of the primary references it appears that the central tubular passageway within the inner quartz tube 16 is left empty and indeed there appears to be no need to fill this inner space since both of these known heaters are intended for heating fluids that flow through inner and outer annular passageways of the heater.

Furthermore, it is clear that neither of the primary references would lead one skilled in the heating of injection molding equipment to modify the teachings of the

Schmidt reference by replacing the long outer sleeve 44 with relatively short first and second rings. One reason for this is that the teachings of Schmidt with respect to the use of an axial slot 54 are directly contrary to the requirements of the heaters shown in the primary references, both of which require the use of unbroken, solid, annular quartz tubes in order to conduct the ultra-pure fluids. Thus one skilled in the construction of tubular heaters would not consider these two references in order to modify the heater of Schmidt.

Neither the use of nor the advantages of using rings which have a relatively short inner surface that engages the outer surface of the inner tube are taught or suggested by the Schmidt reference. The desirability of having this relatively short inner surface on each ring is specifically mentioned in the application in paragraph 29. The advantages of the claimed heater assembly over the heater assembly of the Schmidt reference are as follows:

(a) If the outer tube in the reference is made of a preferred material, such as titanium, this outer tube is much more expensive than the use of two rings made of the same material;

(b) Tubing material like that used in the reference for the outer tube is only loosely tolerant as to its dimensions, particularly its internal diameter, since it is an extruded product. Thus it is difficult to construct a satisfactory heater assembly in the manner taught in the Schmidt reference (note the difference in thermal expansion of the two tubes is quite small);

(c) It is possible to make the two rings for the present heater assembly by precise machining techniques in order to make them to close tolerances.

New claim 28 has been added to provide additional protection for the invention claimed in this application. Full support for the subject material of this claim

can be found in the original description in paragraph 25, lines 1 to 4 and the feature is shown in Figure 1.

In view of the amendments to the claims as explained above and in view of the above submissions, it is respectfully submitted that all of the claims now remaining in the application are in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,

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